Overview of APEC energy situation and APEC twin goals

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Presentation outline

Energy demand and supply trends

- APEC energy supply
- APEC electricity generation
- APEC final energy consumption
- Energy intensities
- CO_2 emissions

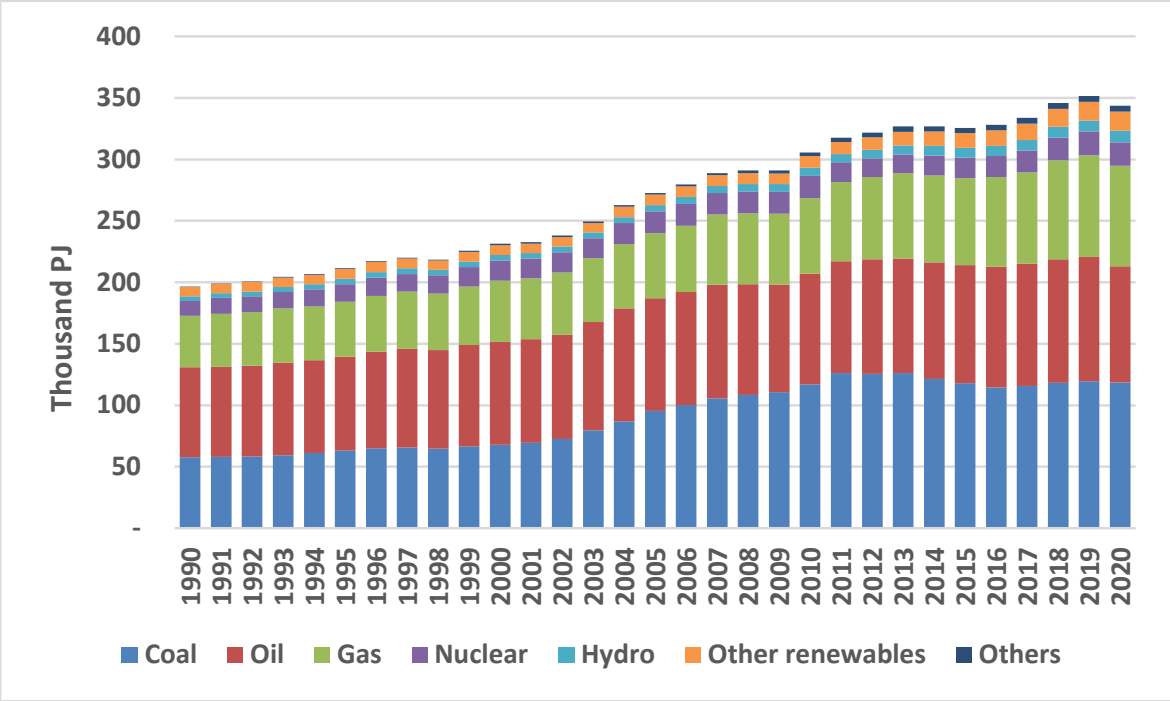
APEC goals

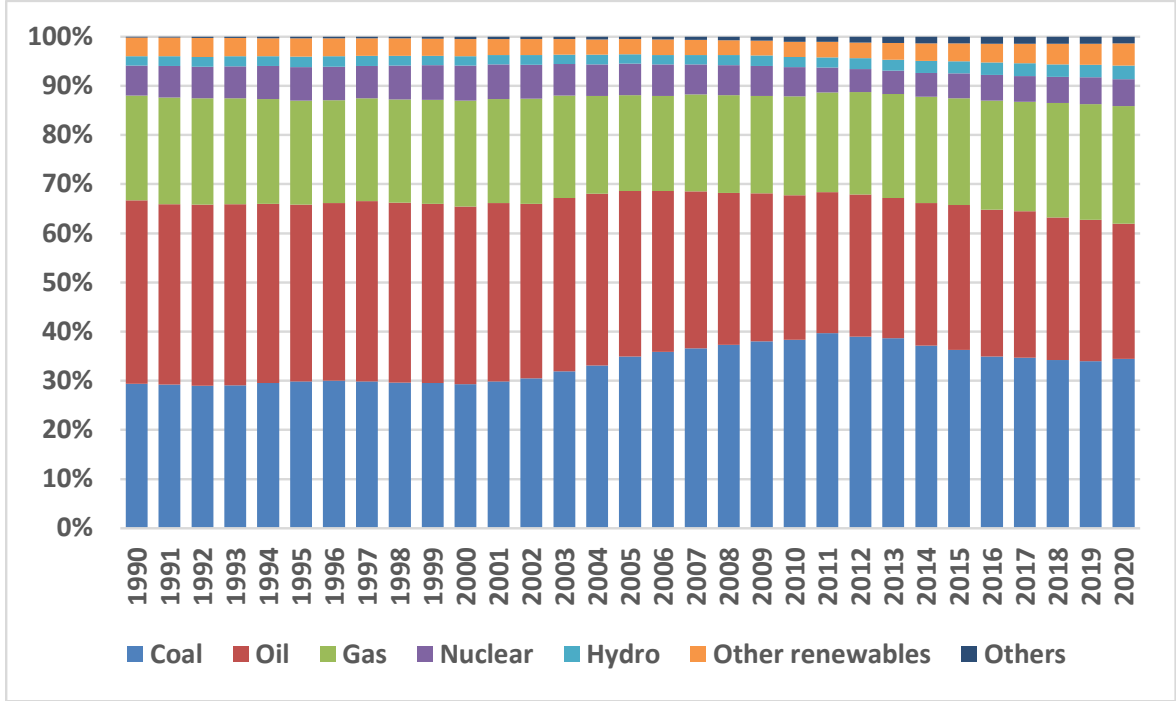
- Energy intensity reduction goal (2005)
- RE doubling goal (2010)

Conclusions

Energy demand and supply trends

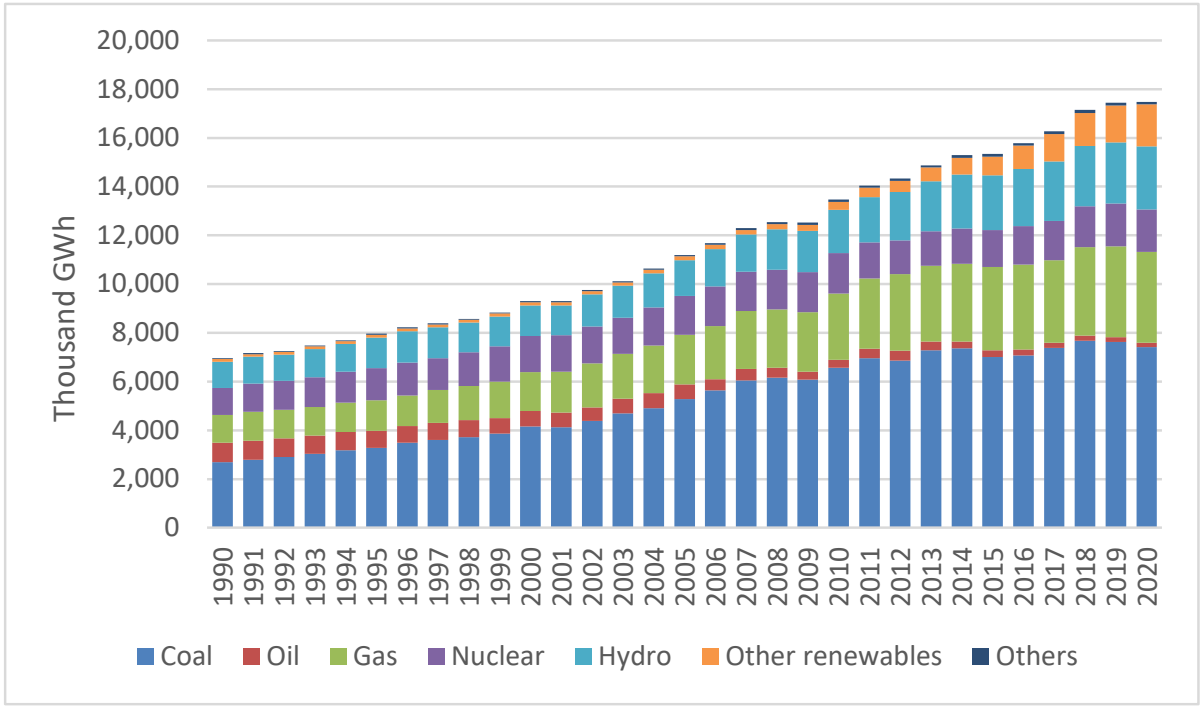
APEC energy supply trend

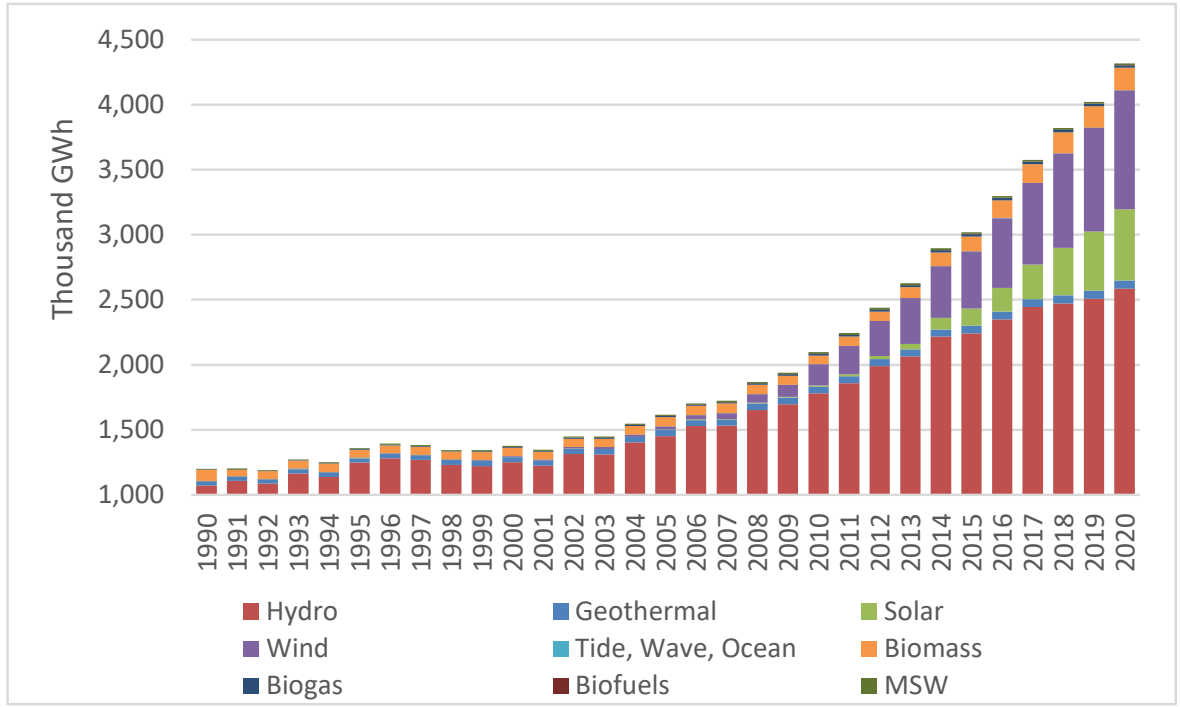




- APEC energy supply grew at a compounded annual growth rate (CAGR) of **1.9% from 1990 to 2020** but decreased by **2.3% (343 542 PJ) from 2019 to 2020** due to decreased economic activities (COVID-19 lockdowns)
- Among fossil fuels, coal had the fastest CAGR of **2.4% from 1990 to 2020**; however, consumption plateaued from 2011
- Oil share decreased from **37% in 1990** to **27% in 2020** due to significant decrease in the use of oil in electricity generation.
- The share of renewable energy increased from **5.8% in 1990** to **7.2% in 2020** after a decrease in the share to **5.2% in 2010**

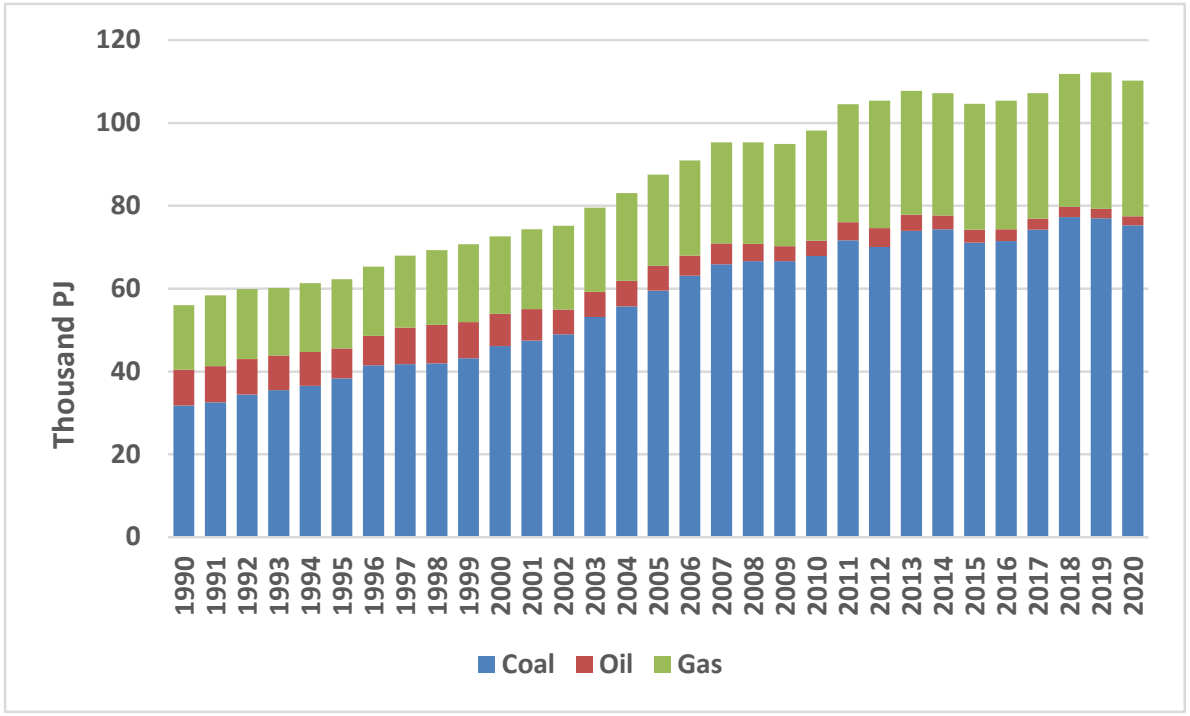
APEC electricity generation

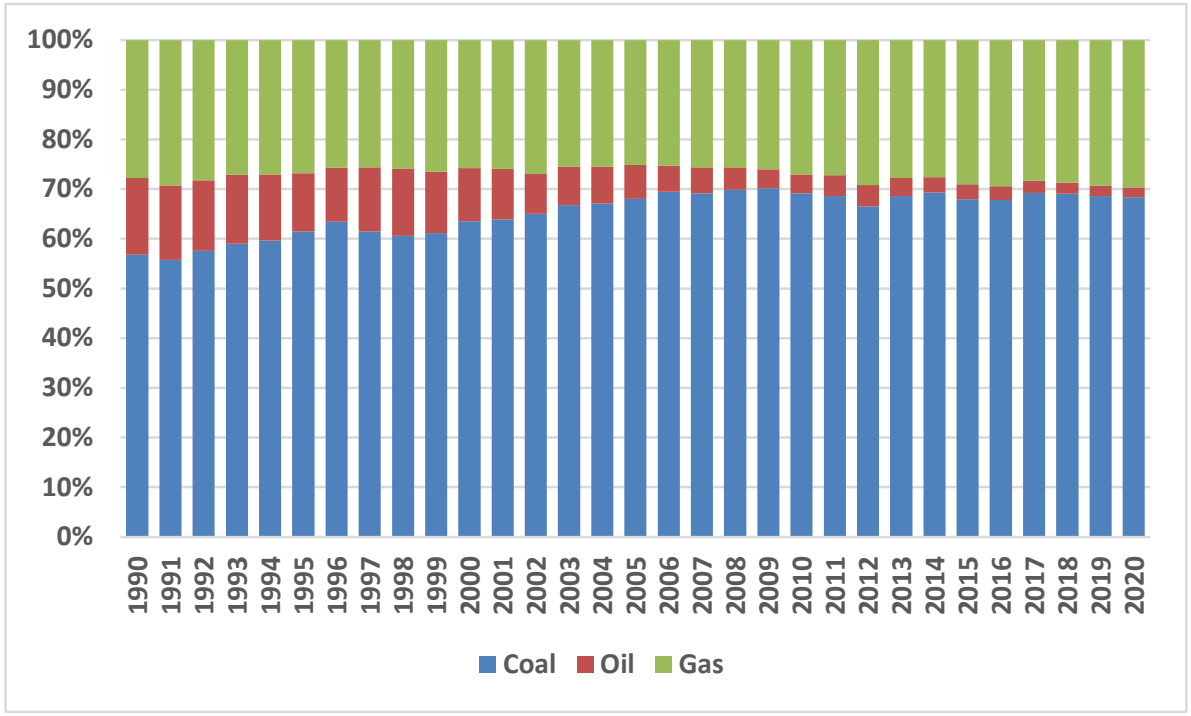




- APEC electricity generation (17 476 TWh) grew at a compounded annual growth rate (CAGR) of **3.1% from 1990 to 2020** but CAGR **from 2019 to 2020 growth was only 0.2%** due to decreased economic activities (COVID-19 lockdowns)
- Among fossil sources, electricity from gas had the fastest CAGR of **4.0% from 1990 to 2020**
- Electricity from oil decreased by a CAGR of **4.9% from 1990** to **2020** resulting in reduced share from **11.3% in 1990 to 1.0% in 2020**
- The share of renewable energy increased from **17.2% in 1990** to **24.7% in 2020** after a decrease in the share of **15.6% in 2010**

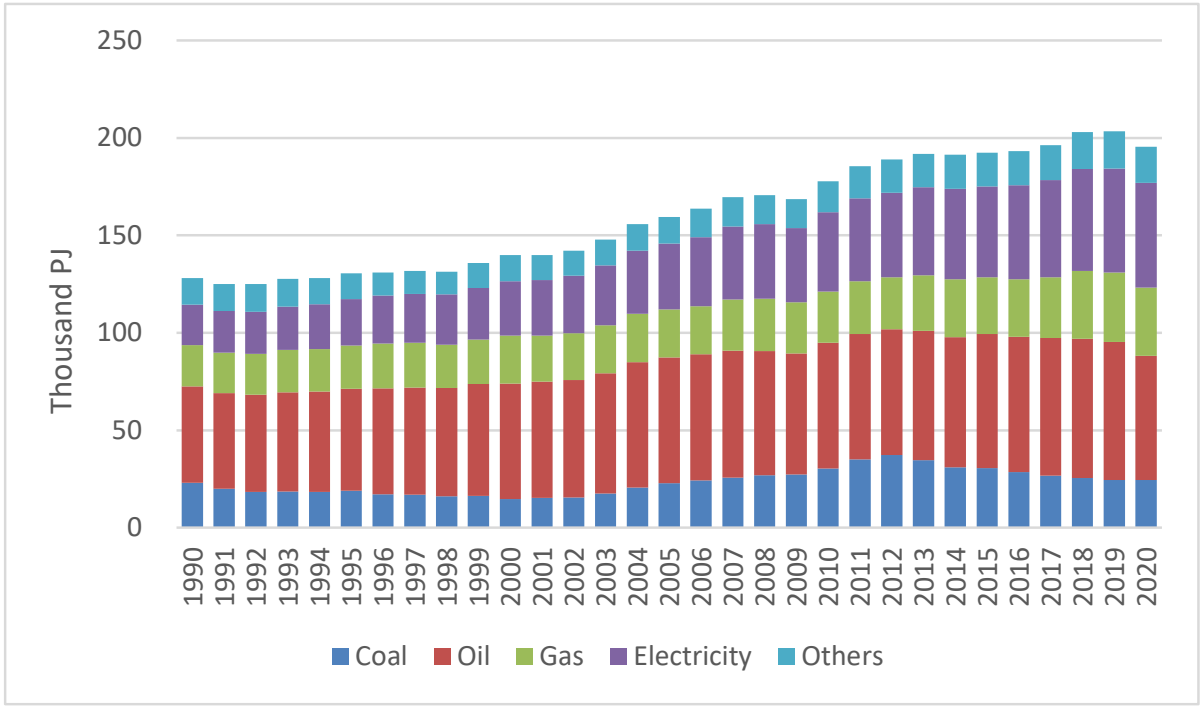
Fossil fuels for electricity generation

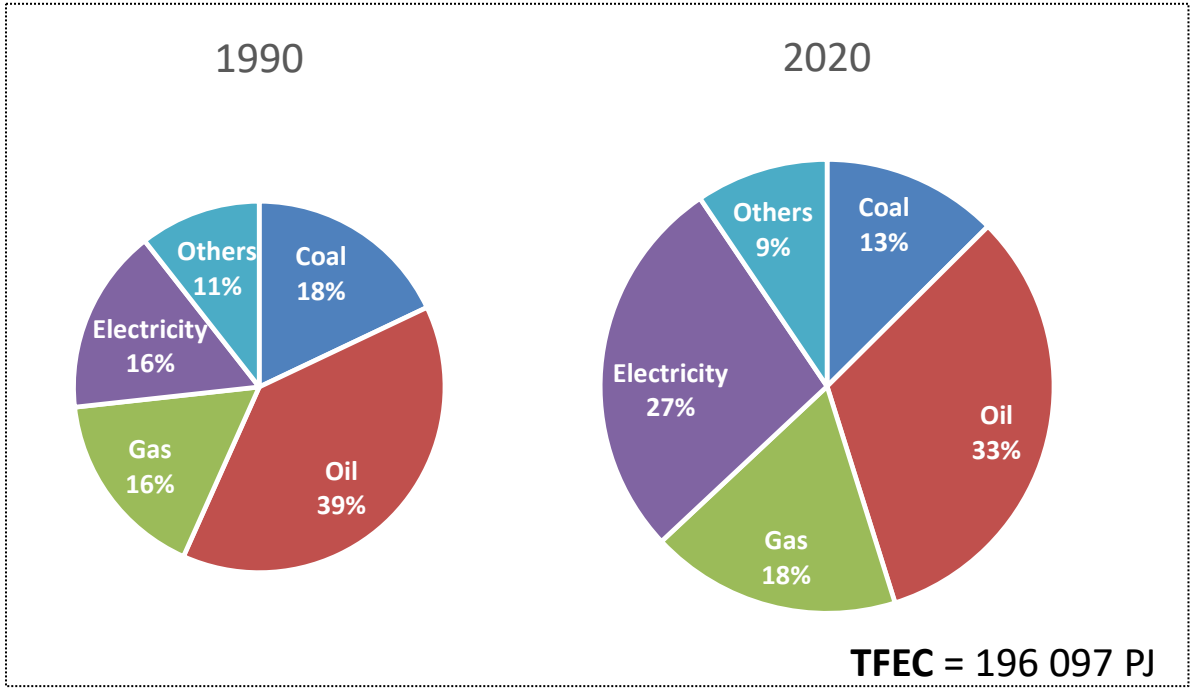




- Fossil fuels (coal, oil and gas) contributed **67% of the total electricity generation in 1990** decreasing to **65% in 2020**
- However, in absolute terms, consumption of these fuels for electricity generation did not decrease except for oil
- Coal increased from **1990 to 2020 by 137%** and gas by **110%**. Oil decreased by **75%**.

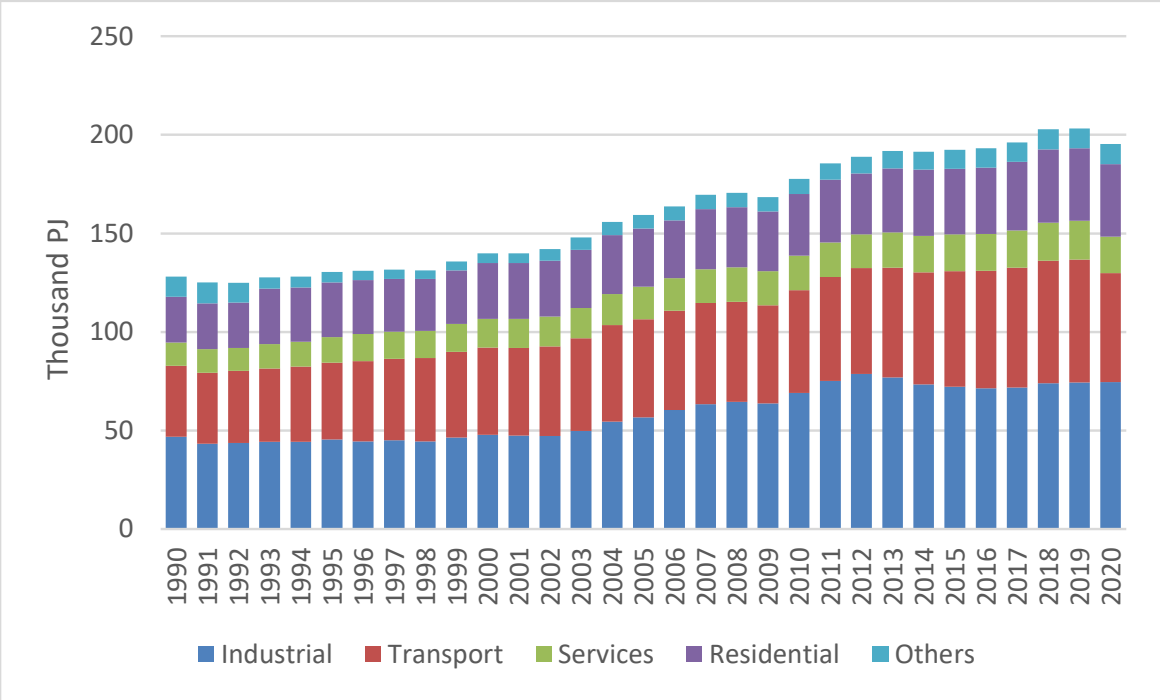
APEC final energy consumption by energy

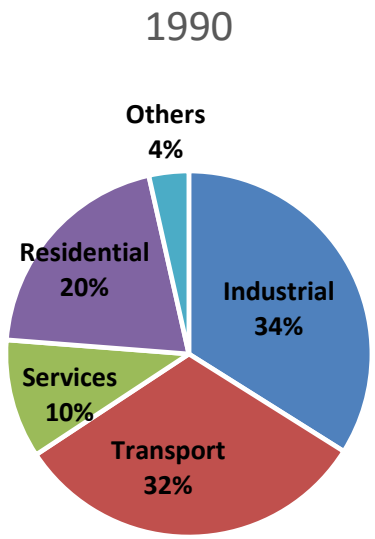


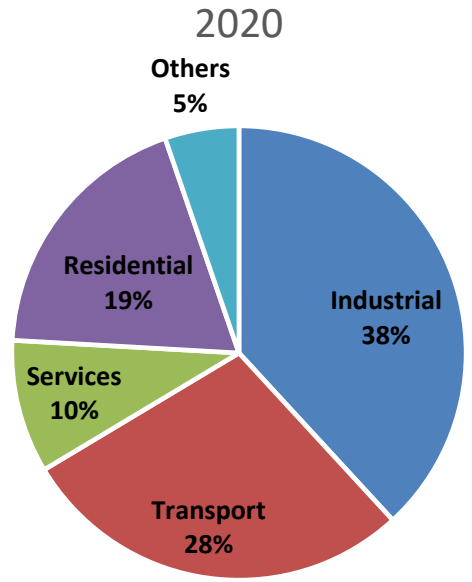


- APEC final energy consumption grew at a compounded annual growth rate (CAGR) of **1.4% from 1990 to 2020** but CAGR **from 2019 to 2020 was -3.8%** due to decreased economic activities (COVID-19 lockdowns)
- Electricity consumption grew the fastest with a CAGR of **3.2% from 1990 to 2020**, **3.3% from 1990-2019** and **1.0% from 2019 to 2020**
- Oil consumption grew at a CAGR of **1.2% from 1990 to 2019** but dropped by **10.1% from 2019 to 2020** due to travel restrictions during the COVID-19 pandemic (**0.8% from 1990 to 2020**)

APEC final energy consumption by sector

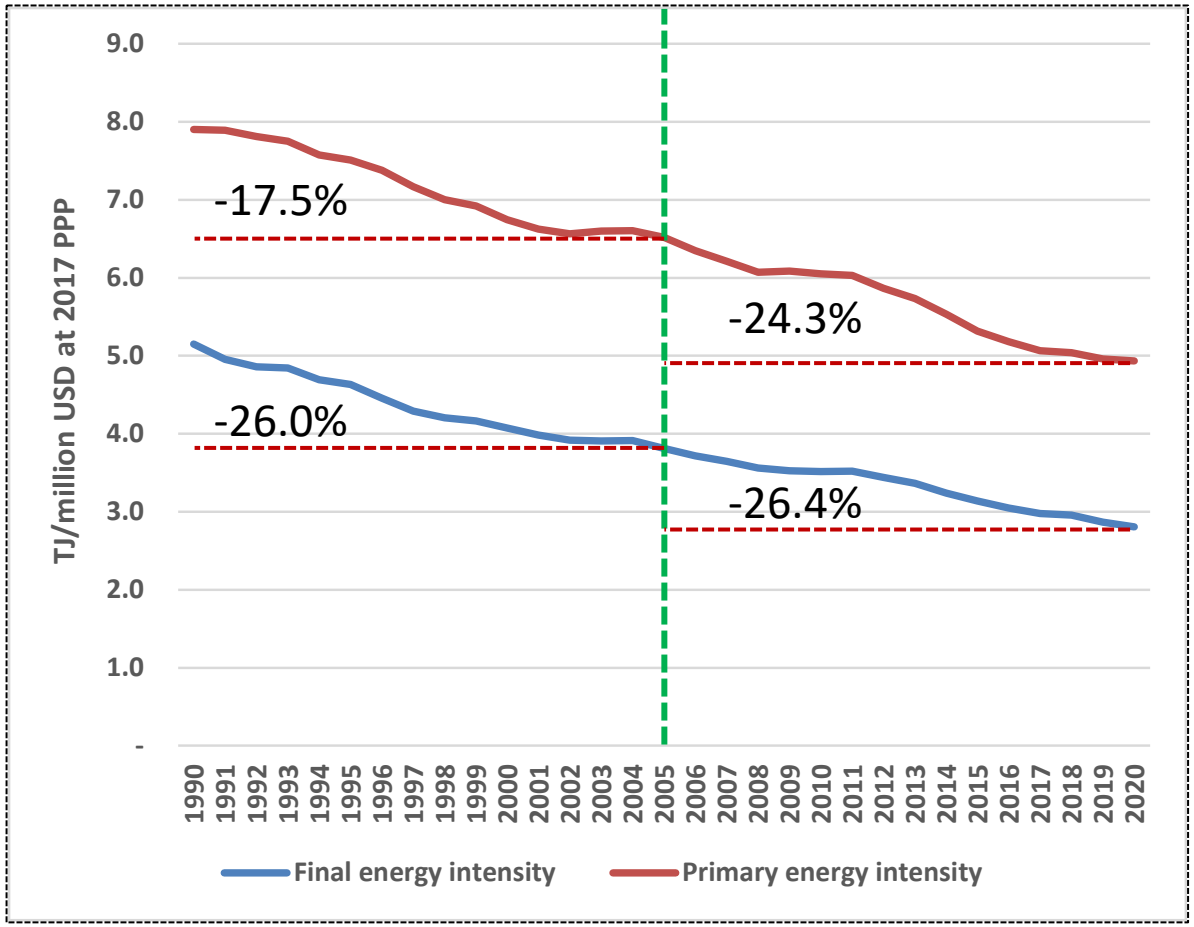






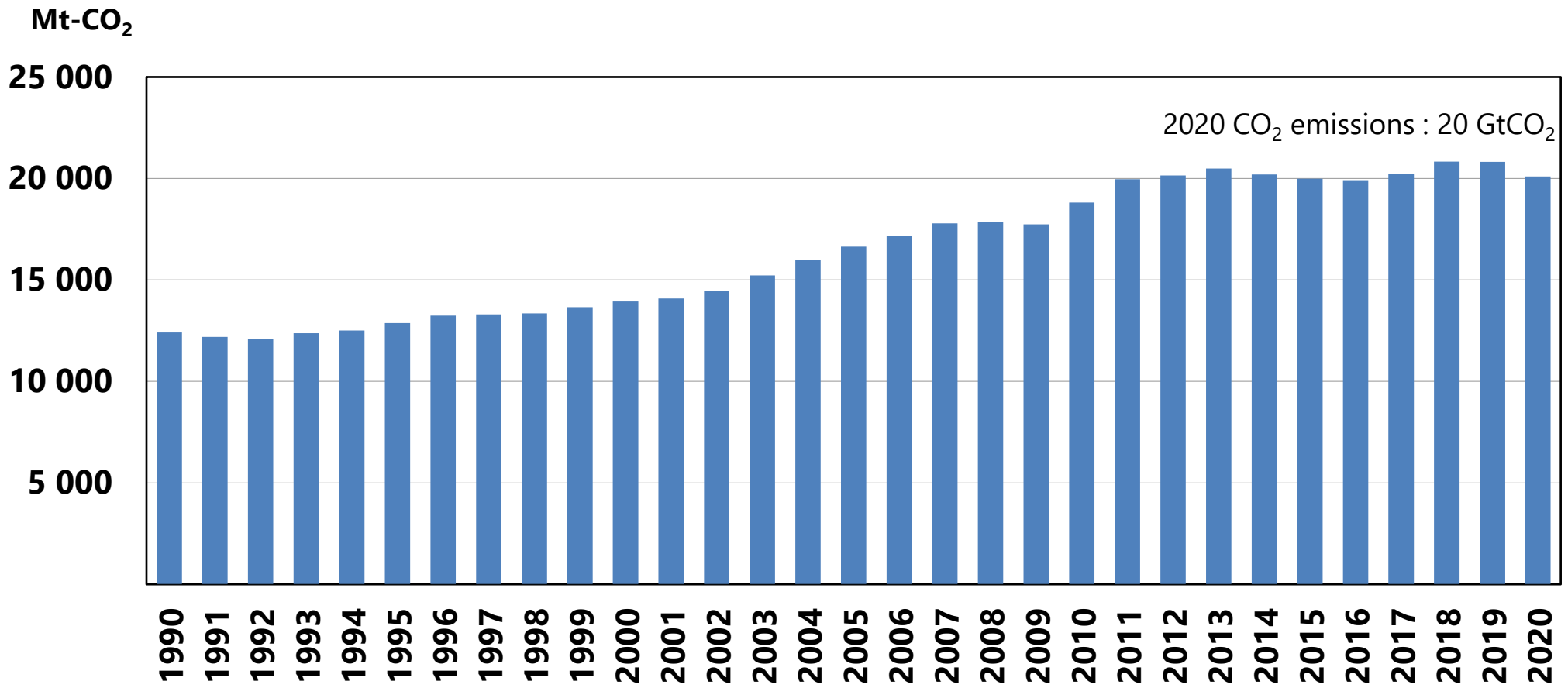
- Industrial energy consumption grew the fastest among the sectors from **1990 to 2020 with a CAGR of 1.6%;** from **2019 to 2020**, it still grew but at a lower rate of **0.3%**
- The transportation grew the fastest between **1990 and 2019 at 1.9% per annum** (CAGR), however there was **11.4% decline from 2019 to 2020**
- Similarly, the services sector (commercial) grew at a CAGR of **1.8% from 1990 to 2019** but **dropped by 6% from 2019 to 2020**

Energy intensities (historical, 1990)



- Final energy intensity of APEC decreased by:
  - **45.5% from 1990 to 2020**
  - **26.0% from 1990 to 2005**
  - **26.4% from 2005 to 2020**
- Primary energy intensity decreased by:
  - **37.6% from 1990 to 2020**
  - **17.5% from 1990 to 2005**
  - **24.3% from 2005 to 2020**

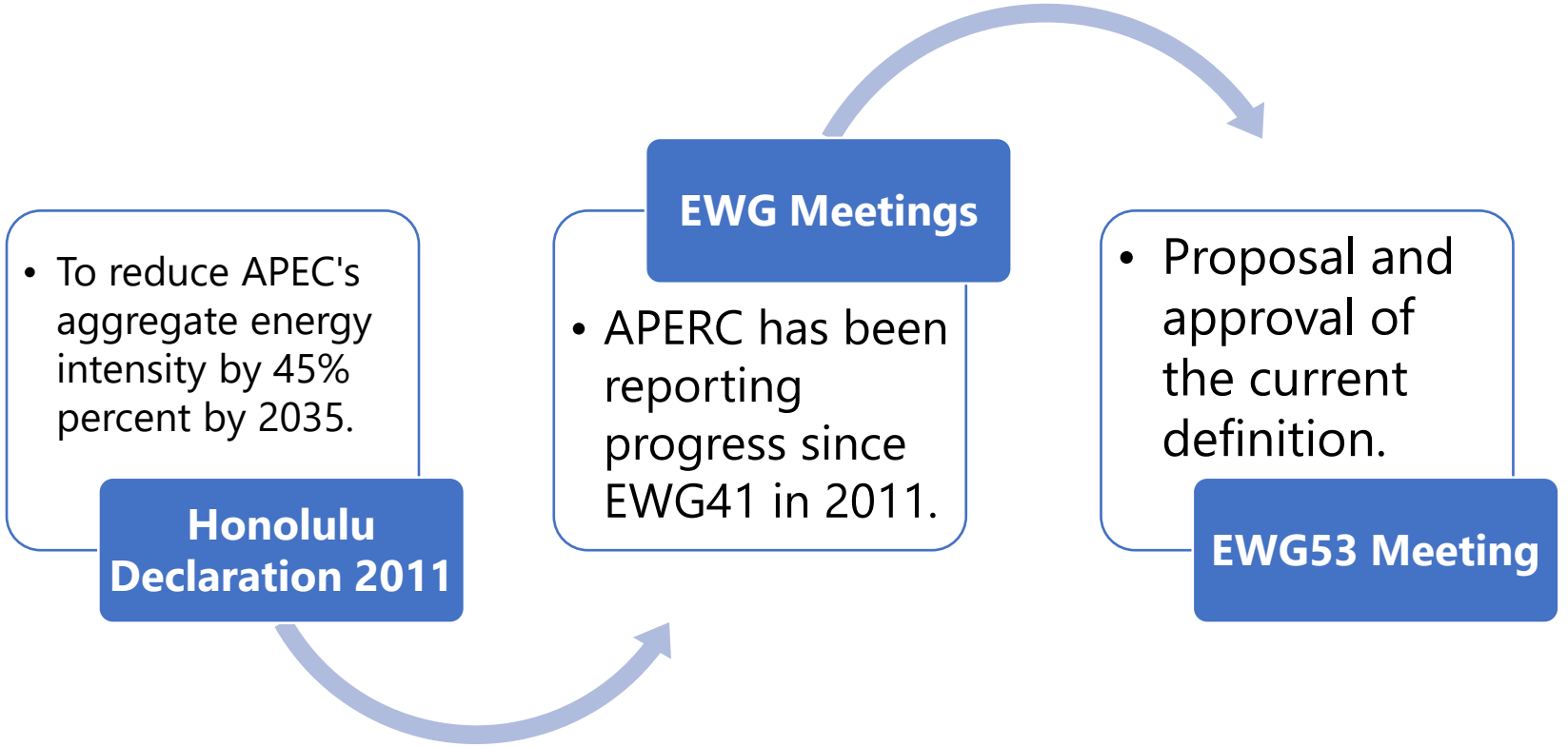
CO_2 emissions



- *2020 has the biggest-ever year-on-year decline of CO_2 emissions in APEC (-3.5%);*
- *level was first seen in 2012.*

APEC goals

APEC goals



❑ *APEC (EGEDA) data were used for monitoring progress on APEC goals*

❑ Agreement was reached at EWG53 to analyse final energy consumption intensity (excluding non-energy), using APEC data.

APEC Final Energy Intensity change

Annual change in APEC final energy intensity, 2006-20

	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	2005-20
Δ in FEC*	2.7%	3.6%	0.6%	-1.3%	5.5%	4.4%	1.8%	1.5%	-0.2%	0.5%	0.5%	1.6%	3.5%	0.3%	-3.8%	23%
Δ in GDP (PPP, constant 2018 USD)	5.4%	5.5%	2.9%	-0.2%	5.7%	4.2%	4.2%	3.8%	3.8%	3.6%	3.4%	4.1%	4.1%	3.4%	-1.8%	66.5%
Δ in final energy intensity	-2.5%	-1.8%	-2.2%	-1.1%	-0.2%	0.2%	-2.3%	-2.2%	-3.9%	-3.0%	-2.8%	-2.4%	-0.6%	-2.9%	-2.0%	**-26.2%**

** **FEC** – final energy consumption (excluding non-energy)*
Δ = change

Sources: APEC statistics (EGEDA), APERC analysis

- Final energy intensity fell 26.2% between 2005 and 2020 (18.8% to the goal by 2035).
- In 2020, COVID-19 caused a decline in GDP and final energy consumption.
- The 2020 result was similar to what we saw in 2009 (the financial crisis).
- What are the implications of 2010 – 2011 for 2021 – 2022?

Primary energy intensity improved y-o-y as well

Annual change in APEC primary energy intensity, 2006-20

	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	2005-20
Δ in PES*	2.6%	3.3%	0.7%	0.0%	4.9%	4.0%	1.1%	1.7%	0.1%	-0.4%	0.8%	1.7%	3.6%	1.7%	-2.3%	26.0%
Δ in GDP (PPP, constant 2018 USD)	5.4%	5.5%	2.9%	-0.2%	5.7%	4.2%	4.2%	3.8%	3.8%	3.6%	3.4%	4.1%	4.1%	3.4%	-1.8%	66.5%
Δ in primary energy intensity	-2.6%	-2.1%	-2.2%	0.2%	-0.7%	-0.2%	-3.0%	-2.0%	-3.6%	-3.9%	-2.5%	-2.3%	-0.4%	-1.7%	-0.5%	**-24.3%**

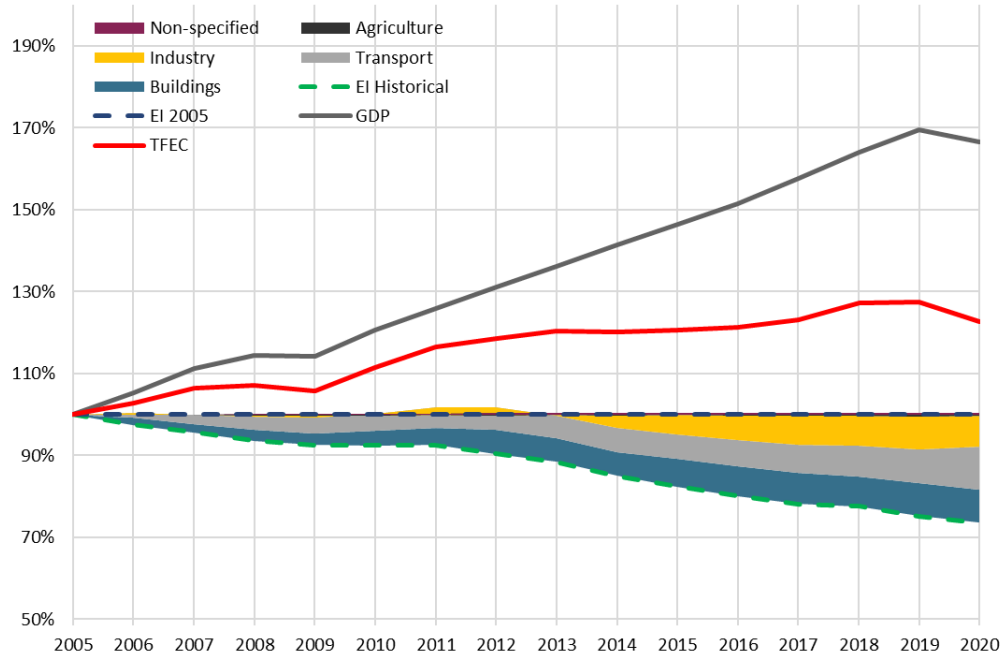
* **PES** – primary energy supply

Sources: APEC statistics (EGEDA), APERC analysis

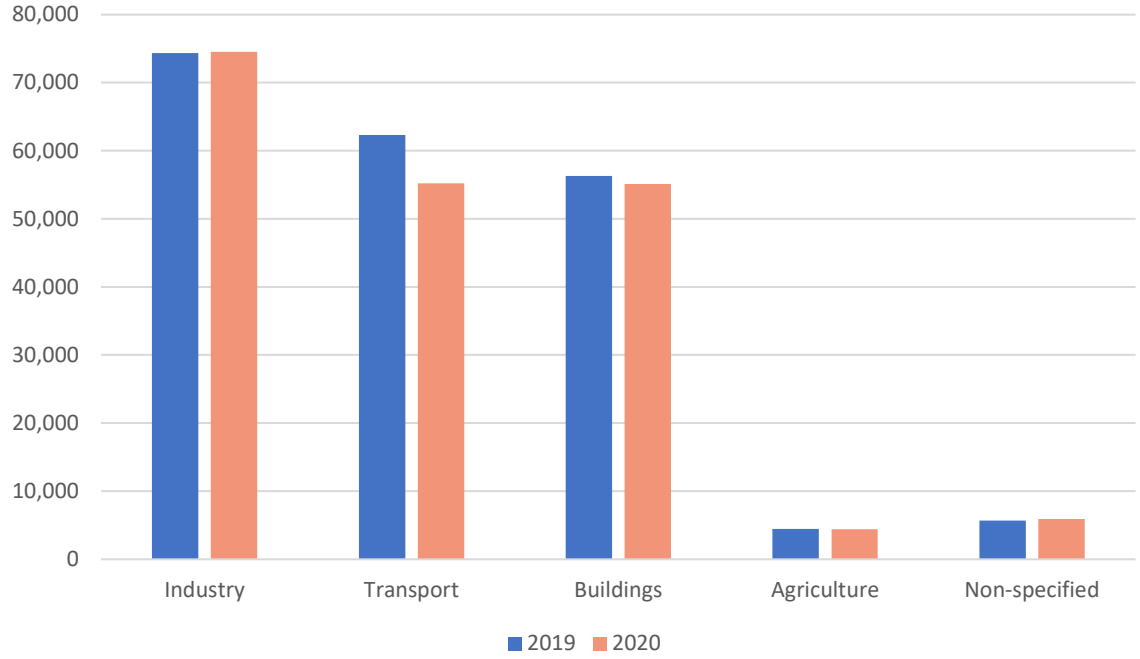
- At EWG62, APERC was asked to also show supply intensity.
- Year to year changes are generally similar to changes in final energy demand intensity
- Patterns of the two series appear to diverge in last three years.

In 2020, the largest drop in energy use was in transport

Subsector contribution to Energy Intensity from 2005-2020



Final Energy Consumption: 2019 versus 2020 (PJ)

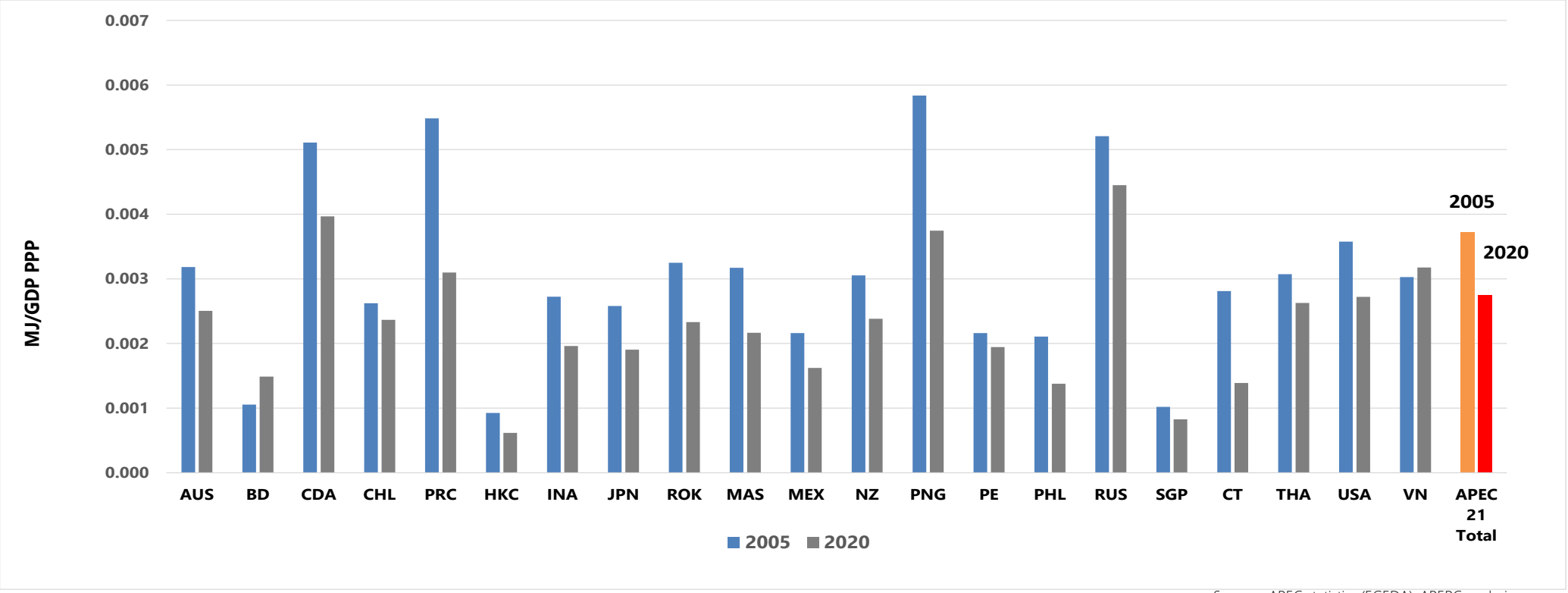


Sources: APEC statistics (EGEDA), APERC analysis

- Compared to 2019, final energy consumption in transportation fell 11.4% in 2020, likely the result of COVID-19 mobility restrictions.

Energy intensity varies widely between economies

Energy intensity: Megajoules per 2018 USD (PPP GDP)



Sources: APEC statistics (EGEDA), APERC analysis.

Note: energy intensity improvement is a collective goal.

Renewable share doubling goal milestones

EWG 47 (May 2014) - US proposed the APEC aspirational goal of doubling the share of renewable energy by 2030 and noted that it interacted with APEC's aspirational energy intensity goal.

EMM 11 (Sep 2014) - "Doubling the share of renewables in the APEC energy mix, including in power generation, from 2010 levels by 2030."

EWG 54 (Nov 2017) - EWG decided that traditional biomass will not be counted; IRENA's definition of renewable energy is recommended; APEC data should be used for monitoring progress; and the goal should be monitored on both the supply and demand side.

Renewable energy continues to gain share

Primary energy supply, PJ

	2010	2020	% change
Non-renewables	**287,866**	**315,490**	**9.6%**
Coal	117,084	118,423	1.1%
Oil	90,037	94,440	4.9%
Gas	61,451	82,034	33.5%
Other non-renewables	19,295	20,594	6.7%
Traditional biomass	**3,209**	**2,886**	**-10.1%**
Modern renewable energy	**14,641**	**25,129**	**71.6%**
Modern biomass	4,148	5,457	31.5%
Hydro	6,396	9,292	45.3%
Geothermal	1,473	1,793	21.7%
Solar	157	2,159	1277.7%
Wind	586	3,295	462.6%
Other renewables	1,882	3,133	66.5%
Total	**305,717**	**343,505**	**12.4%**
Modern RE share	**4.79%**	**7.32%**	**52.7%**

Final energy consumption, PJ

	2010	2020	% change
Non-renewables	**163,800**	**173,930**	**6.2%**
Coal	30,471	24,513	-19.6%
Oil	64,516	63,727	-1.2%
Gas	26,147	34,901	33.5%
Electricity	34,570	40,605	17.5%
Heat	7,882	9,837	24.8%
Other non-renewables	213	347	62.5%
Traditional biomass	**3,209**	**2,886**	**-10.1%**
Modern renewable energy	**10,693**	**18,580**	**73.8%**
Electricity	6,230	13,168	111.3%
Heat	64	58	-10.0%
Modern biomass	2,824	2,847	0.8%
Other renewables	1,575	2,508	59.3%
Total	**177,702**	**195,397**	**10.0%**
Modern RE share	**6.02%**	**9.51%**	**58.0%**

Note: Consumption of electricity and heat from renewables is calculated from the share of total electricity and heat production.

Source: APEC data.

Renewable power generation doubled over the last decade

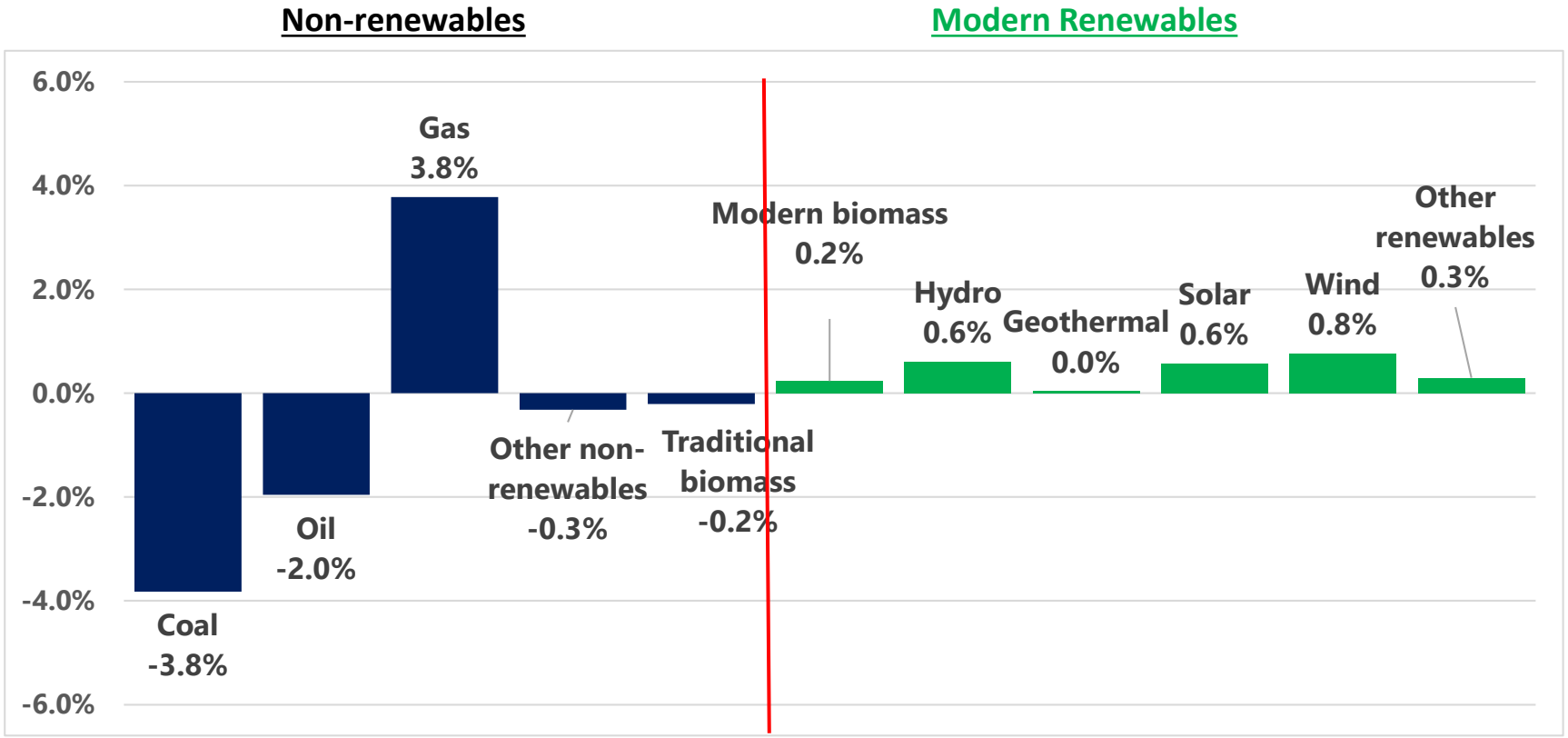
Electricity Generation, TWh

	2010	2020	% change
Non-renewables	**11,374**	**13,160**	**15.7%**
Coal	6,576	7,417	12.8%
Oil	324	176	-45.7%
Gas	2,713	3,726	37.3%
Nuclear	1,658	1,742	5.0%
Other non-renewables	102	100	-2.5%
Modern renewable energy	**2,099**	**4,316**	**105.6%**
Modern biomass	67	172	157.3%
Hydro	1,780	2,584	45.2%
Geothermal	53	63	18.6%
Solar	9	548	5990.5%
Wind	163	915	462.6%
Other renewables	27	33	19.1%
Total	**13,472**	**17,476**	**29.7%**
Modern RE share	**15.58%**	**24.69%**	**58.5%**

- In 2020, modern renewable energy provided a quarter of total power generation

In energy supply, coal and oil lost shares to gas and renewables . . .

Percent change in fuel shares in **primary energy supply**, 2010-2020

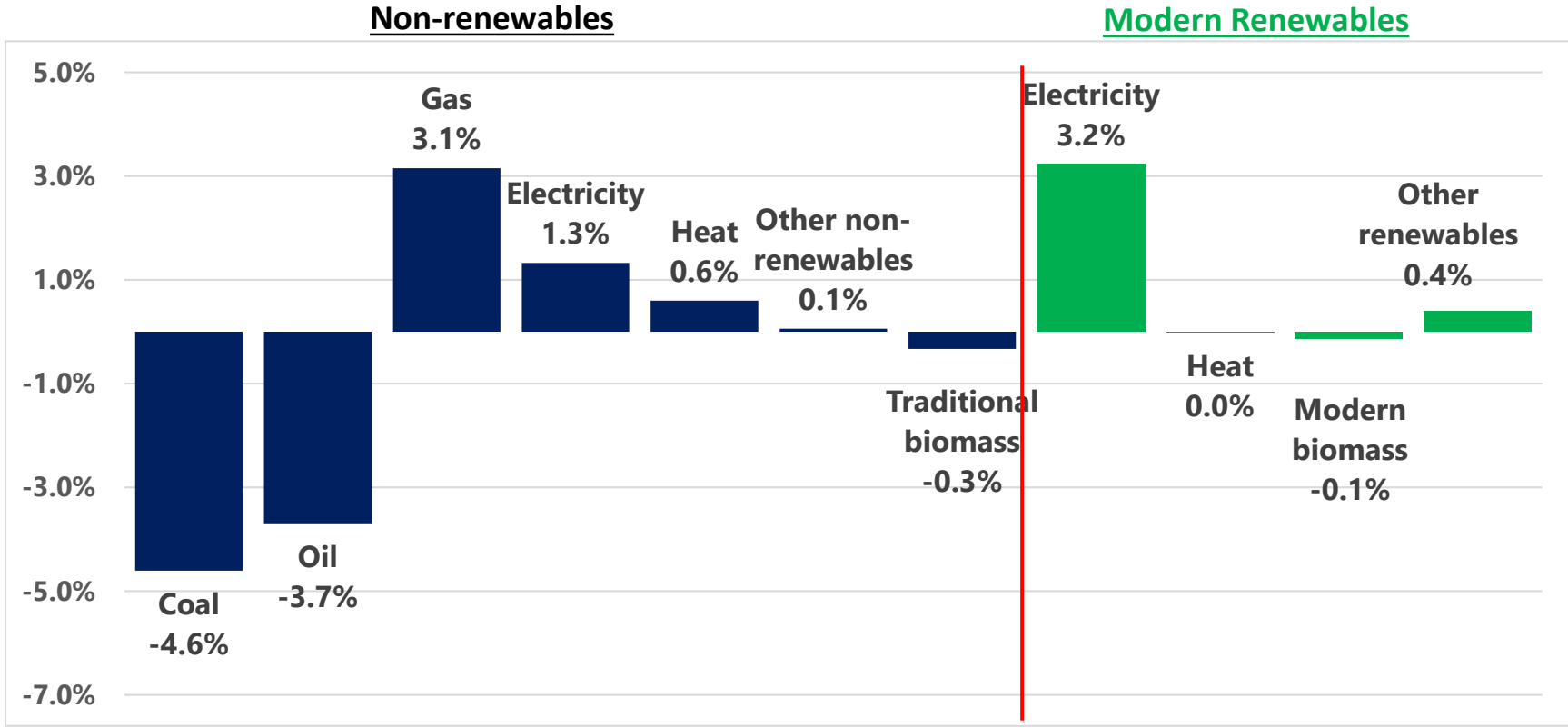


Note: Renewable energy includes electricity and heat generated from renewable energy sources
Source: APEC data

- From 2010 to 2020, the renewable share increased 2.5 percentage points, 53% of the way to the goal.

In final energy use, the pattern was similar

Percent change in fuel shares in **final energy consumption**, 2010-2020



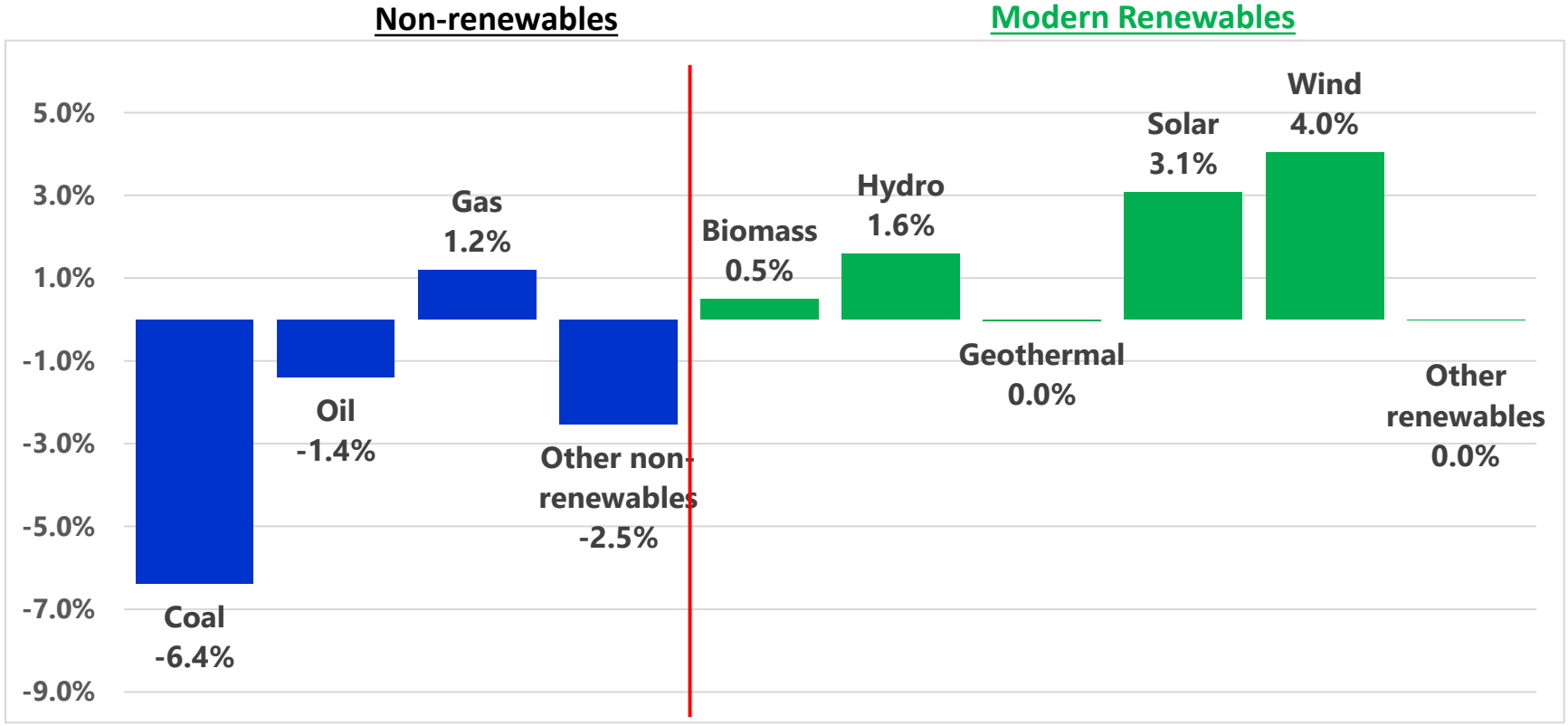
Note: Renewable energy includes electricity and heat generated from renewable energy sources

Source: APEC data.

- From 2010 to 2020, the renewable share increased 3.5 percentage points, 58% of the way to the goal.

Coal and oil lost shares to gas and renewables

Percent change in electricity generation market share, 2010-2020

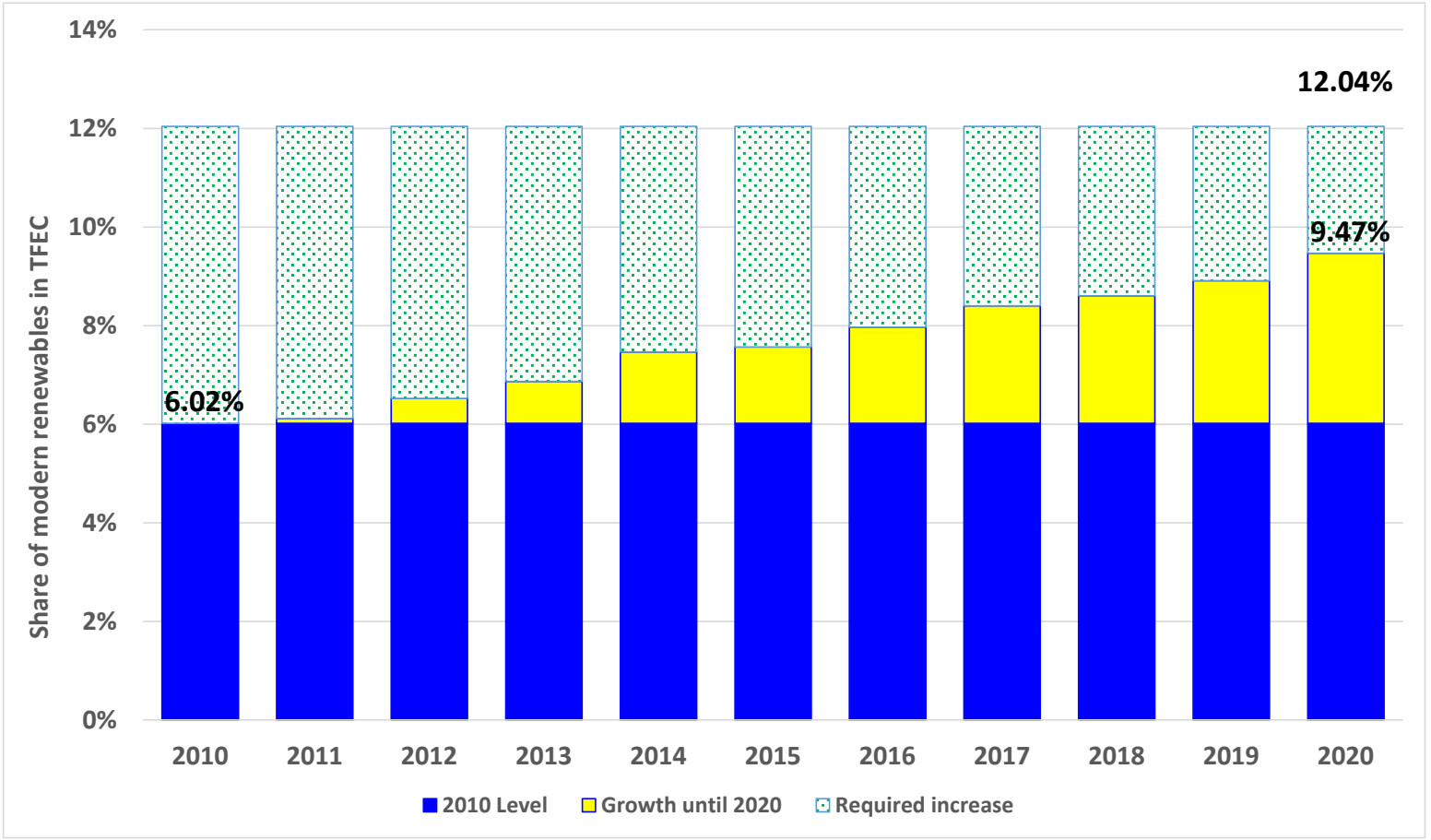


Note: Renewable energy includes electricity and heat generated from renewable energy sources

Source: APEC data.

- *From 2010 to 2020, the renewable share increased 9.1 percentage points, 59% of the way to the goal.*

Tracking the APEC renewable energy doubling goal



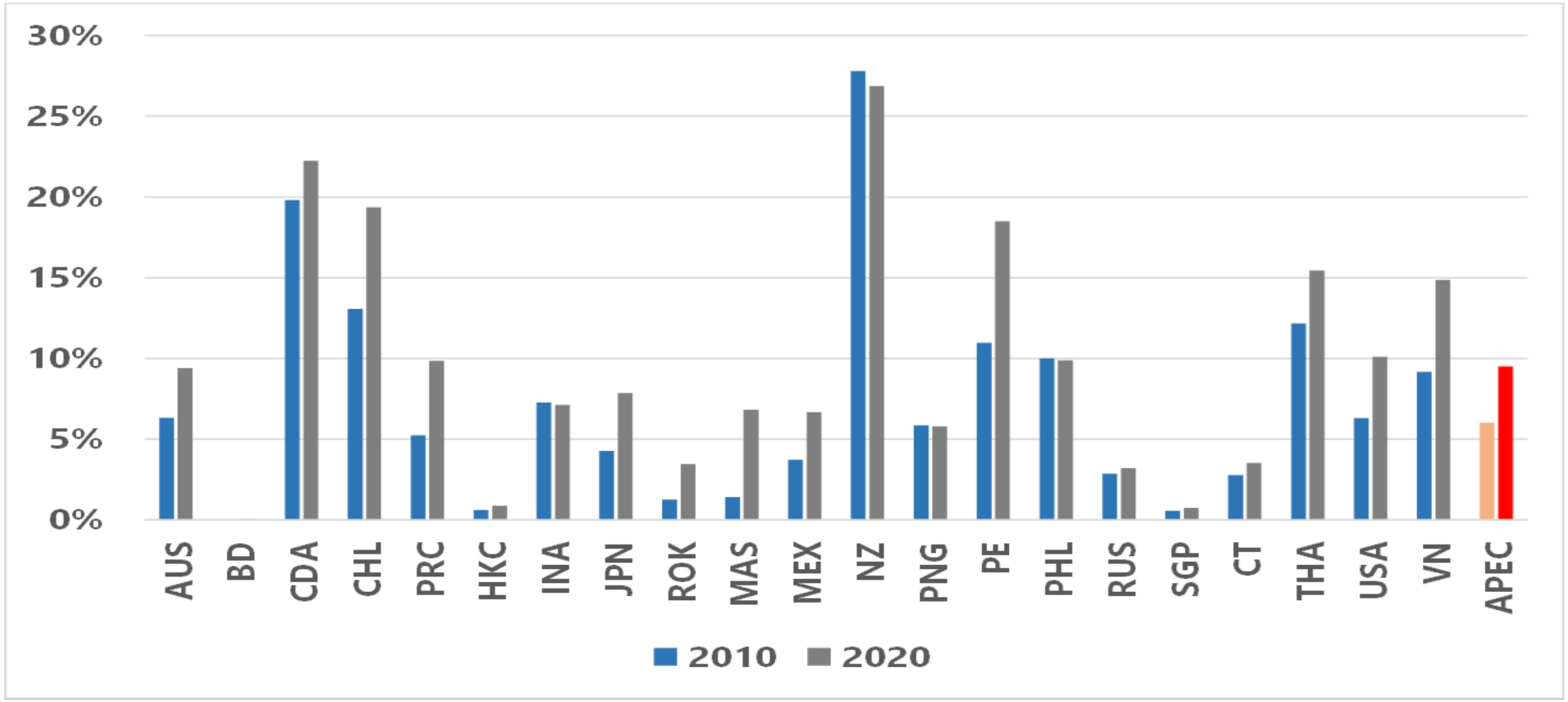
Just 2.47% more in the next 10 years

3.45% increase in the last 10 years

In 2020, which is halfway between 2010 and 2030, APEC has increased RE share in final energy consumption by 3.45%, needing to increase by just 2.47% more in the next 10 years (2020 to 2030)

RE share of energy use varies widely by economy

Renewable energy share of final energy consumption in 2010 and 2020



Source: APEC data

Note: the RE doubling goal is a collective goal.

Conclusions

- APEC's energy consumption increased by 75% over 30 years from 1990 to 2020.
  - However, final energy intensity or final energy consumption per unit of GDP decreased by 45.5% during the same 30-year period
  - With this trend, APEC's aspirational goal of reducing energy intensity by 45% from 2005 to 2035 or also, over 30 years, seems to be achievable
- Renewable energy share decreased over time from 1990 to 2010 due to the faster growth of energy consumption versus the growth of renewable energy
  - However, from 2010 to 2020, growth of renewable energy was faster than that of non-renewable energy resulting in higher share of renewables in the energy mix
  - Lockdowns due to the COVID-19 pandemic resulted in decreased consumption of energy in APEC by as much as 8,200 PJ from 2019 to 2020, but this did not affect the growth of renewable energy consumption during the same period
  - Efforts should be sustained to achieve APEC's aspirational goal of doubling the share of renewable energy from 2010 to 2030
- What happens after 2020 (post pandemic energy consumption) should be closely monitored.

Asia-Pacific Economic Cooperation

APERC Asia Pacific Energy Research Centre

Thank you for your kind attention.

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